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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MSC INTERNAL NOTE MSC--CF--D--67--8

CREW TRAINING PROGRAM FOR LTA-8 THERMAL VACUUM TEST

Prepared by

MISSION TRAINING SECTION

MISSION OPERATIONS BRANCH

FLIGHT CREW SUPPORT DIVISION

December 12, 1967

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

MSC INTERNAL NOTE MSC-CF-D-67-8

CREW TRAINING PROGRAM
FOR
LTA-8 THERMAL VACUUM TEST

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1.0 SUMMARY

The accomplishment of the formal training program (approximately 400 hours) will prepare the crew for participation in the thermal vacuum testing of the Lunar Module (LTA-8). Coincident with the formal training are the many hours of crew participation in design reviews, acceptance reviews, informal briefings, study, physical conditioning and support activities such as flying proficiency, suit fits, etc. The sum total of all activities, complementary in nature, will aid the crew in developing a level of proficiency necessary for participation in the extensive test program as required by Environmental Ground Operations Procedures I-124. See table 5.1 for subject matter and hourly allocation.

2.0 INTRODUCTION

This document defines the pretest training and related operational activities of the crew assigned to the LTA-8 Thermal Vacuum Test program. It is primarily intended as a guide to the crew and personnel responsible for crew training. Modification of this document is the responsibility of the Mission Training Section, FCSD, with the approval of the Director of Flight Crew Operations. The training coordinator will publish and distribute every two weeks the latest crew training schedules and quantitative information concerning crew training status.

The basis of the training set forth in this plan was derived from the LTA-8 Test Plan (ref. 1), the LTA-8 Test Profile (ref. 2) and the Grumman Aircraft Engineering Corporation LTA-8 MSC LM-2 Flight Support document (ref. 3).

3.0 TRAINING PROGRAM

3.1 Spacecraft Test Participation

Crew participation in spacecraft tests and associated tests (Operational Checkout Procedures) is an important factor in the vehicle and procedures development and has the corollary function of providing valuable training experience in increased knowledge and operational capability. The crew will be briefed on the OCP's in which they will participate by GAEC and MSC test engineers.

Contained in table 5.2 is a list of spacecraft Operational Checkout Procedures (OCPs) in which the crew may participate. Crew participation in the spacecraft tests are categorized as (a) crew mandatory, or (b) crew commanders option, (ref. 4 and 5).

3.2 Briefings and Reviews

3.2.1 LM Briefings - A series of operationally oriented systems briefings shall be presented by GAEC instructors. The assigned crew has, in previous months, completed the LM-2 systems briefings, however, for purposes of updating they will complete the series again. See table 5.3 for subject matter and hourly allocation.

3.2.2 LTA-8 Briefings - Subsequent to the LM briefings, systems briefings describing the differences between the LTA-8 spacecraft and LM flight configuration shall be presented by GAEC instructors. See table 5.3 for subject matter and hourly allocation.

3.2.3 Photography Briefings - The crew shall receive four hours of briefings presented by the Mission Operations Branch, FCSD on the functional aspects of the photographic equipment stowed on the spacecraft. The crew shall be provided with cameras and film to practice and perfect their operational techniques. Upon completion of spacecraft installation and configuration, MOB personnel shall evaluate lighting conditions and brief the crew on their findings and recommendations.

3.2.4 Medical Briefing - The Environmental Medicine Branch (EMB) of the Medical Operations Office shall brief the crew on diet control, pretest preparation and contents and utilization of the medical kit. The wearing and trouble shooting of the biomedical vest will be covered by Brown, Root and Northrup (BRN) technicians in SESL. The EMB will provide briefings on medical experiments to be performed during the test, and assist SESL in developing medical aspects of the Development Test Procedures (DTP).

3.2.5 Provisions Briefing - Approximately 2 to 3 hours will be devoted to familiarization with the diet packets (LM selection) to be stowed in the

spacecraft. The training, administered by the Biomedical Specialities Branch of the Biomedical Research Office will include methods of food reconstitution and food sanitation and disposal. The crew shall be provided representative sample meals with which to develop facility of preparation and eating habits and from which to select most palatable meals.

3.2.6 Extravehicular Mobility Unit (EMU) Briefing - The crew will receive a 4-hour briefing and demonstration of the EMU by Crew Systems Division personnel. The EMU consists of the Pressure Garment Assembly (PGA) and the Portable Life Support System (PLSS).

3.2.7 Development Test Procedures - The LTA-8 crew, FCSD support team, GAEC and personnel from SESL will jointly establish the development test procedures. GAEC will provide the preliminary DTP, with subsequent DTP development primarily accomplished as a result of crew participation in meetings, mockup reviews, and practice in the Lunar Module Mission Simulator (LMS). The crew will verify suitability of the Development Test Procedures utilizing the LMS prior to the altitude chamber test.

3.2.8 Mission Rules Reviews - The crew will participate in two scheduled Mission Rules Reviews.

3.2.9 Stowage Reviews - A stowage review will be conducted in the chamber facility for evaluation of the equipment to be carried onboard and its installation. Additional stowage exercises will be conducted at MSC in the LM-mockup or LTA-8 spacecraft as required. See table 5.4 for hourly allocation.

3.2.10 Training Reviews - Continual communication between the crew and the training coordinator will exist to insure adequacy of the overall training program, to discuss time allocation and sequencing, and to update and plan training activities to achieve a mission-ready crew prior to the Test Readiness Review Board.

3.2.11 Team Meetings - The crew and the support team will meet periodically to review overall mission status and to establish action item responsibility as applicable.

3.2.12 Test Readiness Review Board Review - Prior to man-rating TV-1 and TV-2, the crew will take part in a management review of the overall preparedness to proceed with testing. Major areas examined at these reviews are the spacecraft, test facility, crew training, emergency procedures and related support efforts.

3.2.13 Test Vehicle - AGE/ACE Interface Briefing - The Test Programs Management Office (SESL) shall arrange a crew briefing on the relationship of the test spacecraft to Aerospace Ground Equipment (AGE) and Automatic Checkout Equipment (ACE). This shall include such items as EPS, ECS, and Communications interface.

3.2.14 Space Environmental Simulation Laboratory Briefing - A familiarization briefing on altitude chamber operations, components, emergency repressurization, crew support equipment including rescue facilities, procedures, and spacecraft support equipment shall be presented by Test Operations Branch personnel. This briefing will be conducted at the beginning of the "man rating" tests.

3.2.15 Bench Check - Prior to the Crew Compartment Fit and Functional Check (CCFF), the Support Team Section, FCSD will display for crew review the equipment to be stowed aboard the spacecraft. The function, operation, and manipulation of each will be completely discussed and reviewed at this time.

3.2.16 Spacecraft Fire Briefing - The crew will receive a lecture and demonstration on the proper use of the fire suppression equipment in the spacecraft and the chamber facility prior to CCFF. Further fire suppression training will be in accordance with SESL requirements and the Spacecraft Fire Training Plan (ref. 6).

3.3 Simulator Training

3.3.1. Lunar Module Mission Simulator (LMS) - The crew will receive training in performing both nominal and emergency mission tasks on the LMS at MSC and KSC. Simulator training will primarily consist of systems practice related to the particular requirements of the test and to verify Development Test Procedures (DTP). Each training exercise (approx. 4 hours) will include a briefing and debriefing. The briefing will cover important aspects of each exercise (normal operation, emergency operation, simulator limitation) and crew techniques and procedures. Crew questions, performance and discrepancies will be reviewed during the debriefing. (see table 5.5 for the LMS training exercises to be conducted).

3.4 Special Purpose Trainers and Facilities

3.4.1 Extravehicular Mobility Unit (EMU) Checkout - Prior to Pressure Garment Assembly (PGA) altitude verification, the crewmembers will don their respective suits for a 2-hour familiarization checkout exercise (ambient conditions) under supervision of CSD personnel. Operational and fit discrepancies will be corrected as a result of this exercise.

PGA verification involving crew participation shall be accomplished in three modes of operation: (1) PGA in CSD altitude chamber, (2) PGA and PLSS in CSD altitude chamber, and (3) PGA interfaces with insertion umbilicals in SESL Airlock.

Additional suit training will be accomplished during CCFF exercises, Internal Environment Simulation (IES) testing at GAEC (ref. 7), the

man-rating test, and ingress/egress procedures development and training exercises. (Ref. 8). A summary of this training is contained in table 5.4.

3.4.2 Internal Environment Simulation (IES) - The crew will participate in the IES at GAEC, which is a constraint on the LTS-8 thermal vacuum test. The crew is required to participate in this test to man rate the spacecraft environmental system. It also provides valuable training for the crew concerning the operational characteristics of the environmental system prior to commencement of the LTA-8 thermal vacuum test. Prior to the IES the crew will have received (a) ECS System briefings from GAEC engineers, (b) concluded simulator exercises involving ECS procedures, and (c) received a thorough briefing from the GAEC test engineer(s) concerning chamber facility emergency procedures.

3.4.3 Ingress/Egress Training - The unique nature of the spacecraft ingress/egress via umbilical and ladder, necessitates considerable procedures development and training. SESL personnel, with the assistance of the EVA Section, FCSD, shall develop procedures and techniques, both normal and emergency, utilizing the (1) LTA-8/Chamber B mockup, and (2) the spacecraft. The crew will participate in the development phase and subsequently train towards proficiency in the established procedures.

3.4.4 Physiological Training - Completion of the Physiological Training Course as presented by the Physiological Training Branch, Medical Operations Office, is a requirement prior to participation in altitude chamber runs. The course will include four to five hours of lectures on the physiological aspects of space environment. The second phase of this training will require the successful completion of a supervised near vacuum chamber run. This training will be accomplished during the PGA verification tests.

3.4.5 Mockup Training - Under direction of the Support Team Section the crew will utilize the LTA-8 mockup at MSC to review stowage procedures, to practice normal and emergency ingress/egress training and PLSS hookup. (See table 5.4).

3.4.6 Spacecraft Fire Training - The crew will observe demonstrations on spacecraft fires and fire extinguishers. This will include the crew observing the M-6 "burn tests" (or film thereof) held at MSC. The crew will receive further experience in coping with fire situations by participation in simulated fire suppression exercises in mockups, the LMS, and in conjunction with emergency egress training (ref. 6).

4.0 REFERENCES

1. Anon., LTA-8 Test Plan LTP 938-23001.

2. Anon., LTA-8 Test Profile, Contract NAS 9-1100 dated January 6, 1967.

3. Edgerly, R., LTA-8 MSC LM-2 Flight Support Revision D, Grumman Aircraft Engineering Corporation document dated September 25, 1967.

4. Borman, F., Flight Crew Participation in OCPs, memorandum CB-67-197, dated June 15, 1967.

5. Hahne, R. L., Crew Participation in LTA-8 OCPs at MSC, Spacecraft Systems Branch memorandum dated August 2, 1967.

6. Ward, T. M., Spacecraft Fire Training Plan, Mission Training Section document dated December 12, 1967.

7. DeVos, F. J., Apollo Extravehicular Mobility Unit Altitude Verification Test Plan for Hardware to Support IES Test at Grumman Aircraft Engineering Corporation. CSD document A-495.

8. Pearson, O. L., Mockup Development and Crew Training, memorandum dated November 29, 1967.

TABLE 5.1 - CREW TRAINING SUMMARY

ACTIVITY	HOURS
OCPs	120
Briefings and Reviews	
LM	50
LTA-8	16
Photography	4
Medical	4
Provisions	4
EMU	4
Development Test Procedures	16
Mission Rules	8
Stowage	6
Test Readiness Board	6
Interface	6
SESL	6
Bench Check	4
Spacecraft Fire	5
Lunar Module Mission Simulator	40
Special Purpose Training	
EMU Checkout	51
Ingress/Egress	28
Physiological	8
Spacecraft Fire	5
TOTAL	391

TABLE 5.2 CREW PARTICIPATION IN OCPs

MANDATORY

Manned Rating

TV Test 9001

TV Test 9002

CCFF

Integrated Systems Test

COMMANDER OPTION

ECS Functional Checkout

Final Engineering Acceptance Test

Stabilization and Control Functional Check

Atmosphere Revital. Section Leak Check and Contamination Check

Heat Transfer System Checkout

Guidance & Navigation Functional Checkout

Communications Functional Checkout

Electrical Power and Operational Instrumentation Sys. Checkout

TABLE 5.3 - CONTRACTOR SYSTEMS BRIEFINGS (HOURS)

SYSTEM	LM	LTA-8
EPS	5	2
ECS	10	4
Comm	5	2
Instrumentation	5	2
CES	5	1
Prop & RCS	10	2
Abort Guidance	5	1
Radar	5	2
TOTAL	50	16

TABLE 5.4 - INGRESS/EGRESS, STOWAGE AND EMU TRAINING SUMMARY

MODULE/ACTIVITY	STOWAGE REVIEWS		INGRESS/ EGRESS		EMU	
	Exer.	Hrs.	Exer.	Hrs.	Exer.	Hrs.
LTA-8 Mockup	1	3	5	20	3	12
LTA-8 Spacecraft	1	3	2	8	2	8
CSD Chamber					2	6
Airlock					1	3
PGA Checkout					1	2
CCFF					1	4
IES (GAEC)					1	8
Man-Rating					1	8
TOTAL	2	6	7	28	12	51

TABLE 5.5 - LMS CREW TRAINING SUMMARY

EXERCISE	
1	Control Modes (PGNS, AGS, SCS)
2	Propulsion Systems Operations (RCS, DPS, APS)
3	EPS Operation
4	Communications
5	ECS
6	Guidance and Control (IMU alignment, G&N operations and malfunctions, LGC failures
7	Development Test Procedures
8	ECS (Suited)
9	Development Test Procedures
10	Development Test Procedures

LTA-8 MANNED TEST PROGRAM TRAINING SCHEDULE
(short block increments do not indicate actual duration of the activity)

TRAINING ACTIVITY	MONTHS TO TEST COUNTDOWN						6	5	4	3	2	1
SPACECRAFT TESTS (OCP'S)												
IES												
LM SYSTEMS												
LTA-8 BRIEFINGS												
PHOTOGRAPHY BRIEFINGS												
MEDICAL BRIEFINGS												
PROVISIONS BRIEFING												
EMU BRIEFING												
TEST PLAN REVIEWS /DTP REVIEWS												
MISSION RULES REVIEWS												
STOWAGE REVIEWS												
TRRB												
INTERFACE BRIEFING												
SESL BRIEFING												
BENCH CHECK												
FIRE BRIEFINGS												
LMS												
EMU C/O												
INGRESS/EGRESS TRAINING												
PHYSIOLOGICAL TRAINING												
MOCKUP TRAINING												
SPACECRAFT FIRE TRAINING												
DTP DRY RUNS & SIM. EMERG.												
DTP AMBIENT RUNS												

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FIGURE 6.1